

Interactive comment on “The scale problem in quantifying aerosol indirect effects” by A. McComiskey and G. Feingold

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Comments from Benjamin S. Grandey, Rosalind West and Philip Stier:

This is an interesting and useful paper, providing an informative discussion of the importance of spatial scale choices for aerosol–cloud interaction studies. We are pleased to see our previous work referenced in the paper. However, we believe that some misunderstanding may have arisen regarding the interpretation of Grandey and Stier (2010).

The ambiguity is due to the fact that this paper and Grandey and Stier (2010) discuss two different types of analysis scale:

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1. This paper discusses the spatial scales over which aerosol and cloud data may be averaged prior to analysis of aerosol–cloud relationships. Since this is intimately related to assumptions about collocation, it seems sensible to refer to these choices as *colocation scale* or *colocation-aggregation scale* choices. A valid colocation-aggregation scale choice would be one over which aerosol (and possibly cloud) properties at a given observation time can be assumed to be approximately homogeneous.
2. In Grandey and Stier (2010), we discuss the spatial scales over which aerosol–cloud relationships may be analysed for a given colocation scale. It is worth noting that the colocation-aggregation scale used throughout Grandey and Stier (2010) is $1^\circ \times 1^\circ$. For grid boxes of this size, two methods of analysis were investigated: regression slopes can be calculated for each individual grid box, with each contributing data point representing a different day, before averaging these regression slopes over larger regions; or the data for a larger region can be mixed together prior to calculating the regression slopes, with each contributing data point representing a different grid box–day combination. (See Figure 1 of Grandey and Stier, 2010, for a schematic illustration.) Since the analysis scale choices under discussion in Grandey and Stier (2010) are associated with climatological spatial gradients, we now suggest that these could be referred to as *climatological-gradient scale* choices. A valid climatological-gradient scale choice would be one over which aerosol and cloud climatologies can be assumed to be approximately homogeneous.

The discussions of these two types of analysis scale are highly complementary, with both being important considerations for analysis of aerosol–cloud relationships. However, the subtle differences between these two types of analysis scale are important. We would appreciate it if the authors of the current paper could use the opportunity to clarify the distinction, reducing the possibility for further misunderstanding. In light of this, we recommend that the authors consider making a handful of clarifications to the

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manuscript:

- If the authors agree that it would be beneficial, a brief discussion of the distinction between the analysis scales under consideration could be included the first time that Grandey and Stier (2010) is referenced. In particular, the use of the word 'aggregation' is misleading here because it is used elsewhere in the paper to refer to the idea of colocation-aggregation (as discussed above).
- Page 26750. Statistical significance increases for larger colocation-aggregation scales due to a decrease in the variance, as discussed in the paper. However, we believe the primary reason for the increase in statistical significance for larger regions in Grandey and Stier (2010) is due to the increase in data volume contributing to the statistics.
- Page 26758. The reason proposed by Grandey and Stier (2010) for the errors over the stratocumulus regions is that of climatological spatial gradients rather than insufficient resolution of variability. Although the authors of the manuscript under discussion demonstrate that colocation resolution is important, it would not explain the results of Grandey and Stier (2010) which are based on a fixed colocation-aggregation scale of $1^\circ \times 1^\circ$.
- Page 26761. Again, use of 'aggregating' is potentially misleading in relation to the studies commented on by Grandey and Stier (2010).

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